

WHAT IS CLAIMED IS:

1. A method for estimating GPS time in a mobile terminal that operates in a wireless communication system, the method comprising:
  - 5 generating at the mobile terminal a repository of cell-to-GPS timing data that is representative of a timing offset between GPS time and cell time for two or more cells with which the mobile terminal communicates;
  - identifying an originating cell of a received communication signal; and
  - estimating GPS time using the repository of cell-to-GPS timing data, the
  - 10 identity of the originating cell, and a time indicator portion of the received communication signal.
2. The method of Claim 1, wherein generating at the mobile terminal a repository of cell-to-GPS timing data comprises:
  - 15 determining a first timing offset between a time indicator portion of a first communication signal from a first cell and a time indicator portion of a GPS communication signal;
  - determining a second timing offset between a time indicator portion of a
  - second communication signal from a second cell and a time indicator portion of a
  - 20 GPS communication signal; and
  - maintaining the first and second timing offsets and identifiers for the associated first and second cells in the repository of cell-to-GPS timing data.
3. The method of Claim 2, wherein:
  - 25 identifying an originating cell of a received communication signal comprises identifying an originating cell of a third communication signal; and
  - estimating GPS time comprises using the repository of cell-to-GPS timing data, the identity of the originating cell, and a time indicator portion of the third communication signal to estimate GPS time.
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4. The method of Claim 2, wherein generating at the mobile terminal a repository of cell-to-GPS timing data comprises:

determining a time difference between receiving a predetermined portion of a frame structure of the first communication signal from the first one of the cells and receiving a time indicator portion of a GPS communication signal; and

5 determining a time difference between receiving a predetermined portion of a frame structure of the second communication signal from the second one of the cells and receiving a time indicator portion of a GPS communication signal.

10 5. The method of Claim 1, further comprising acquiring GPS signals using the estimated GPS time.

6. The method of Claim 1, wherein generating at the mobile terminal a repository of cell-to-GPS timing data comprises retaining cell-to-GPS timing data for a plurality of the cells in a non-volatile memory in the mobile terminal.

15 7. The method of Claim 1, further comprising transmitting at least a portion of the repository of cell-to-GPS timing data from the mobile terminal to a base station.

20 8. A cell-to-GPS timing data structure used for estimating GPS time at a mobile terminal, the data structure being embodied in a computer readable medium, the data structure comprising:

a cell identifier field that is configured to include more than one cell identifier; and

25 a cell-to-GPS timing offset field that is configured to include more than one timing offset value, each of the timing offset values corresponding to at least one of the cell identifier fields and representing a timing offset between a time reference for communication signals from the associated cell and a GPS time reference.

30 9. The cell-to-GPS timing data structure of Claim 8, further comprising a time drift field that is configured to include data that provides an estimate of timing error rate for the timing offset values.

10. A method for estimating GPS time in a mobile terminal that operates in a wireless communication system, the method comprising:

operating the mobile terminal on a communication channel in a cell in the wireless communication system, the communication channel having a cell time reference;

receiving a GPS communication signal at the mobile terminal, the GPS communication signal having a GPS time reference;

determining in the mobile terminal cell-to-GPS timing data that is representative of a timing offset between the cell time reference and the GPS time reference; and

estimating in the mobile terminal a GPS time based on a time indicator portion of the communication channel and the cell-to-GPS timing data.

11. The method of Claim 10, further comprising:

estimating a timing error rate for the cell time reference of the communication channel; and

estimating in the mobile terminal the GPS time based on the time indicator portion of the communication channel, the estimated timing error rate for the cell time reference, and the cell-to-GPS timing data.

12. The method of Claim 11, wherein estimating a timing error rate for the cell time reference of the communication channel comprises:

measuring a cell time reference;

measuring a GPS time that corresponds close in time to the measured cell time reference;

repeating at least one more time the measuring of the cell time reference and the measuring of the corresponding GPS time; and

estimating the timing error rate for the cell time reference based on variation between corresponding pairs of cell time references and GPS times.

13. A method for estimating GPS time in a mobile terminal that operates in a wireless communication system, the method comprising:

operating the mobile terminal on a communication channel in a cell in the wireless communication system, the communication channel having a time reference;

receiving timing advance data on the communication channel, wherein the timing advance data is indicative of distance between the mobile terminal and a base station that is servicing the communication channel;

determining a time reference for the base station based on the timing advance data and the time reference of the communication channel;

receiving a GPS communication signal at the mobile terminal, the GPS communication signal having a GPS time reference;

generating cell-to-GPS timing data at the mobile terminal that is representative of a timing offset between the time reference for the base station and the GPS time reference; and

estimating GPS time based on the cell-to-GPS timing data and a time indicator portion of a communication signal from the base station.

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14. The method of Claim 13, wherein the communication channel comprises a control channel and a traffic channel, and wherein receiving timing advance data on the communication channel comprises receiving the timing advance data on the traffic channel, and wherein determining a time reference for the base station comprises determining a time reference for the control channel and compensating the control channel time reference based on the timing advance data.

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15. A mobile terminal comprising:

a receiver that is configured to receive communication signals from cells in a wireless communication system;

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a GPS receiver that is configured to receive GPS signals;

a memory containing a repository of cell-to-GPS timing data that is representative of timing offset between GPS time and cell time for two or more cells; and

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a processor that is configured to identify an originating cell of a received communication signal, and is configured to estimate GPS using the repository of cell-to-GPS timing data, the identity of the originating cell, and a time indicator portion of the received communication signal.

16. The mobile terminal of Claim 15, wherein the repository of cell-to-GPS timing data is representative of a timing offset between a first GPS time and a time indicator portion of a communication signal from a first cell, and is  
5 representative of a timing offset between a second GPS time and a time indicator portion of a communication signal from a second cell.

17. The mobile terminal of Claim 15, wherein the GPS receiver is configured to acquire GPS signals using the estimated GPS time.  
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18. The mobile terminal of Claim 15, wherein the memory is a non-volatile memory that retains the repository of cell-to-GPS timing data after power has been removed from the mobile terminal.

19. The mobile terminal of Claim 15, wherein the processor is configured to communicate at least a portion of the repository of cell-to-GPS timing data to a base station.  
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20. A mobile terminal comprising:  
20 a receiver that is configured to receive communication signals from cells in a wireless communication system;  
a GPS receiver that is configured to receive GPS signals, and is configured to determine a GPS time reference from the received GPS signals; and  
a processor that is configured to estimate a cell time reference from the  
25 received communication signals, and is configured to generate cell-to-GPS timing data that is representative of a time offset between the cell time reference and the GPS time reference, and is configured to estimate a GPS time based on a time indicator portion of a received communication signal and the cell-to-GPS timing data.

21. The mobile terminal of Claim 20, wherein the processor is configured to estimate a timing error rate for the cell time reference, and is configured to estimate the GPS time based on the time indicator portion of the received communication  
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signal, the estimated timing error rate for the cell time reference, and the cell-to-GPS timing data.

22. A mobile terminal comprising:
- 5 a receiver that is configured to receive communication signals from cells in a wireless communication system;
- a GPS receiver that is configured to receive GPS signals, and is configured to determine a GPS time reference from the received GPS signals; and
- 10 a processor that is configured to estimate a cell time reference from the received communication signals, and is configured to determine a time reference for a base station based on the cell time reference and timing advance data from the base station, and is configured to generate cell-to-GPS timing data that is representative of a time offset between the time reference for the base station and the GPS time reference, and is configured to estimate a GPS time based on a time indicator portion
- 15 of a received communication signal and the cell-to-GPS timing data.